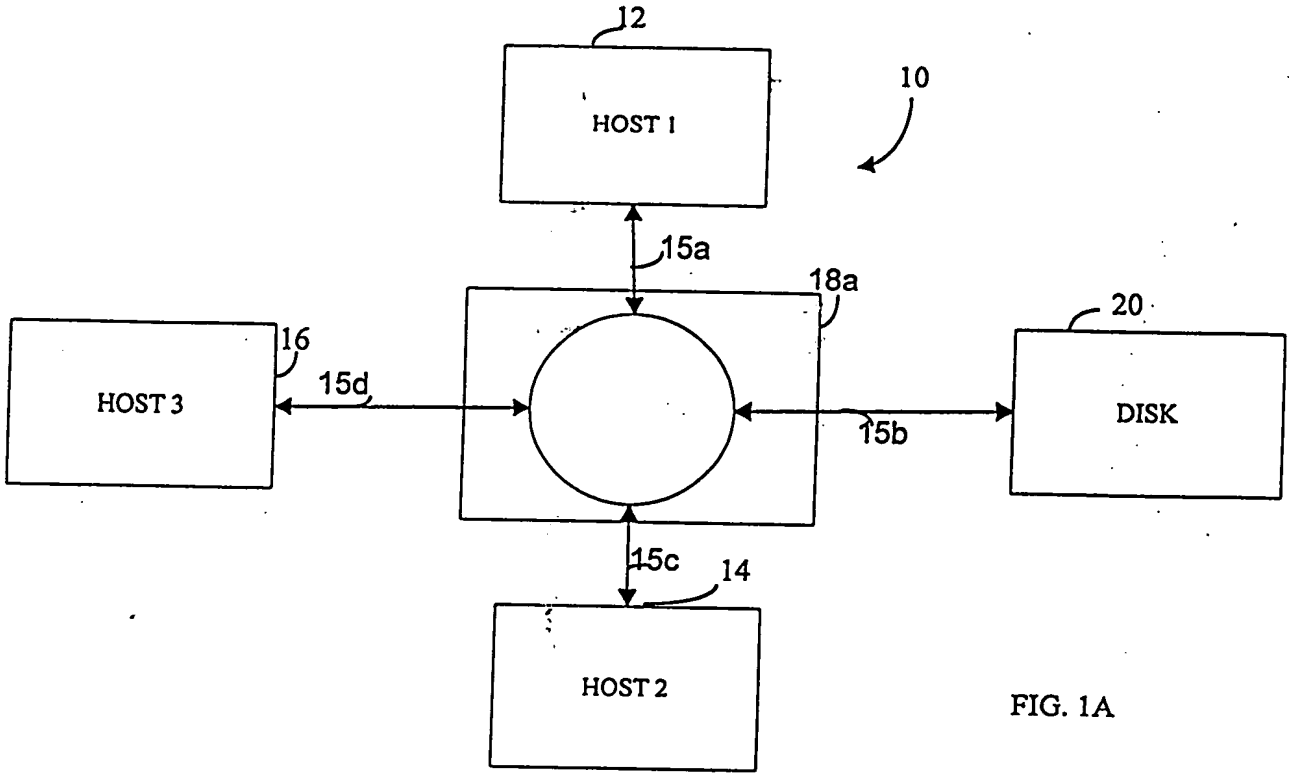

12
HOST 1
10
15a
18a
20
16
HOST 3
15d
15b
DISK
15c
14
HOST 2

FIG. 1A

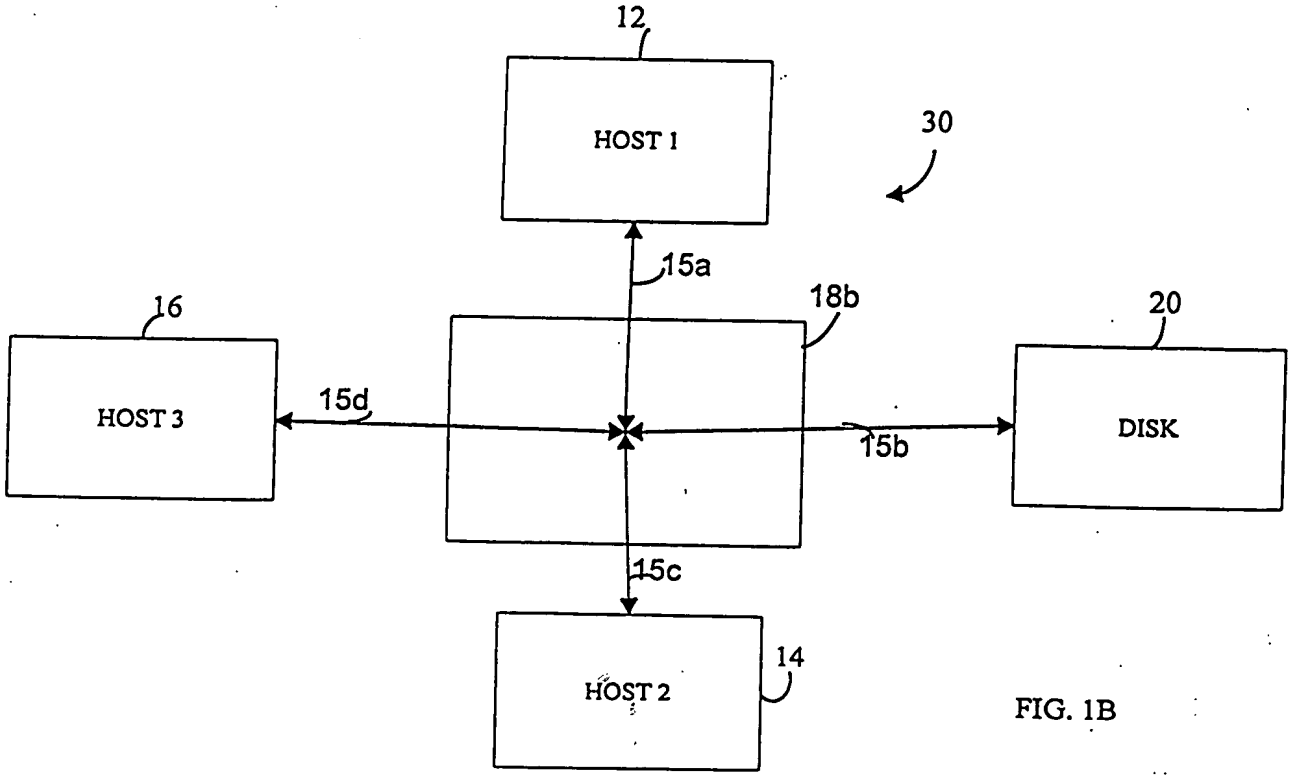

12
HOST 1
30
15a
18b
20
16
HOST 3
15d
15b
DISK
15c
14
HOST 2

FIG. 1B

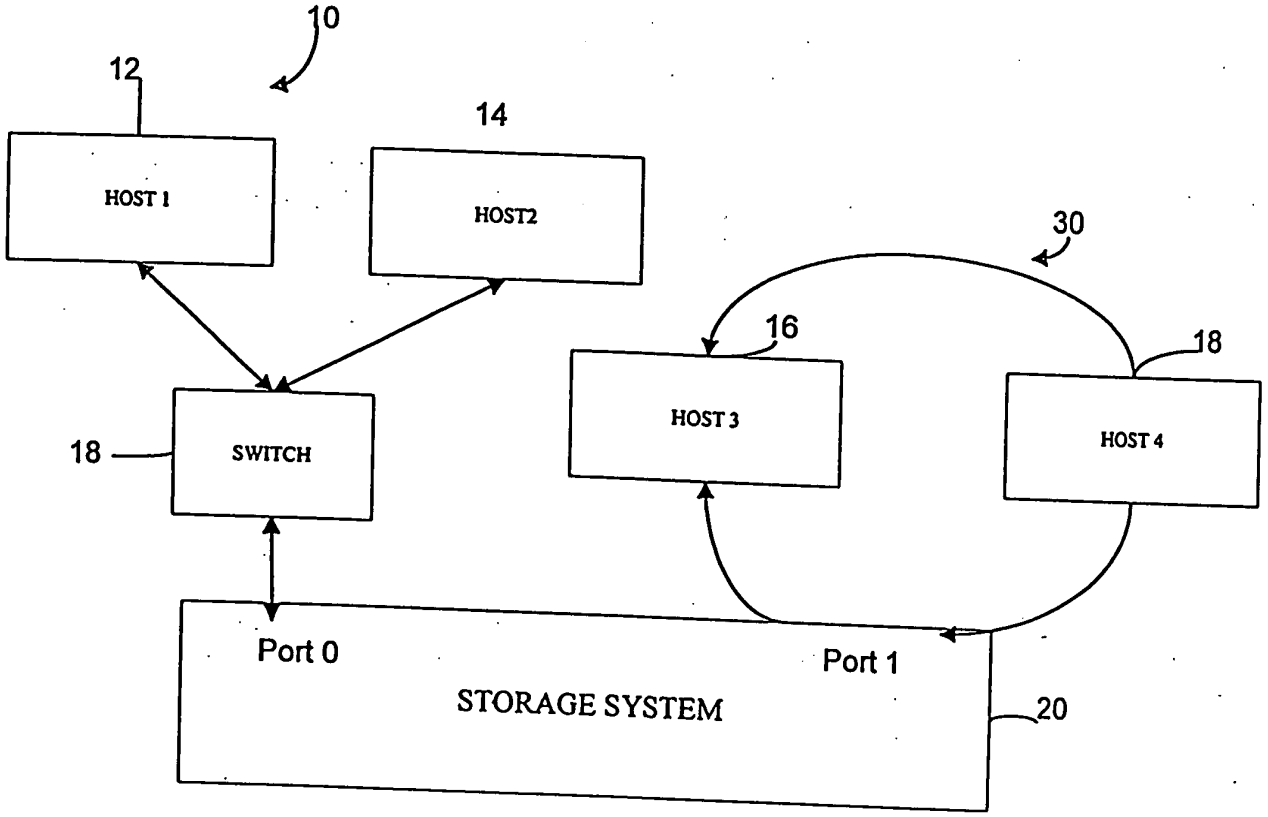

10
12
14
HOST 1
HOST2
30
16
18
18
SWITCH
HOST 3
HOST 4
Port 0
Port 1
STORAGE SYSTEM
20

FIG. 1C

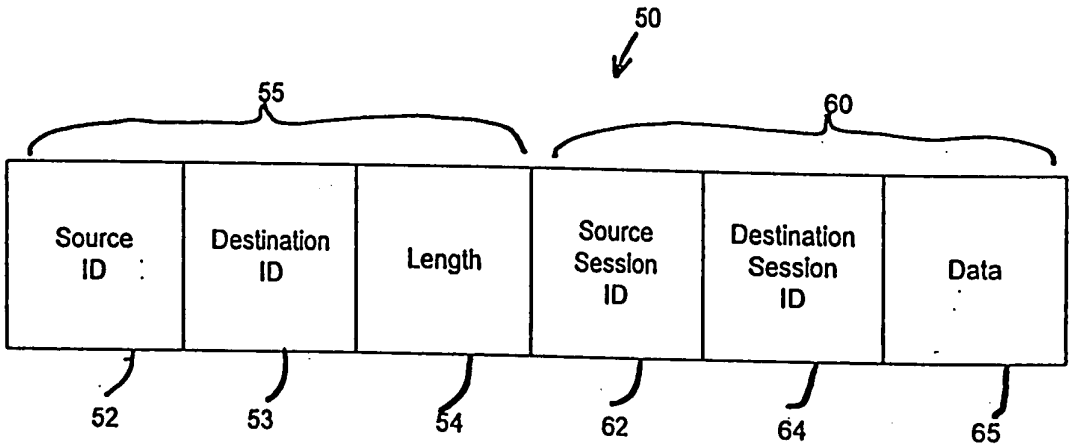

50
55
60
Source ID
Destination ID
Length
Source Session ID
Destination Session ID
Data
52
53
54
62
64
65

FIG. 2

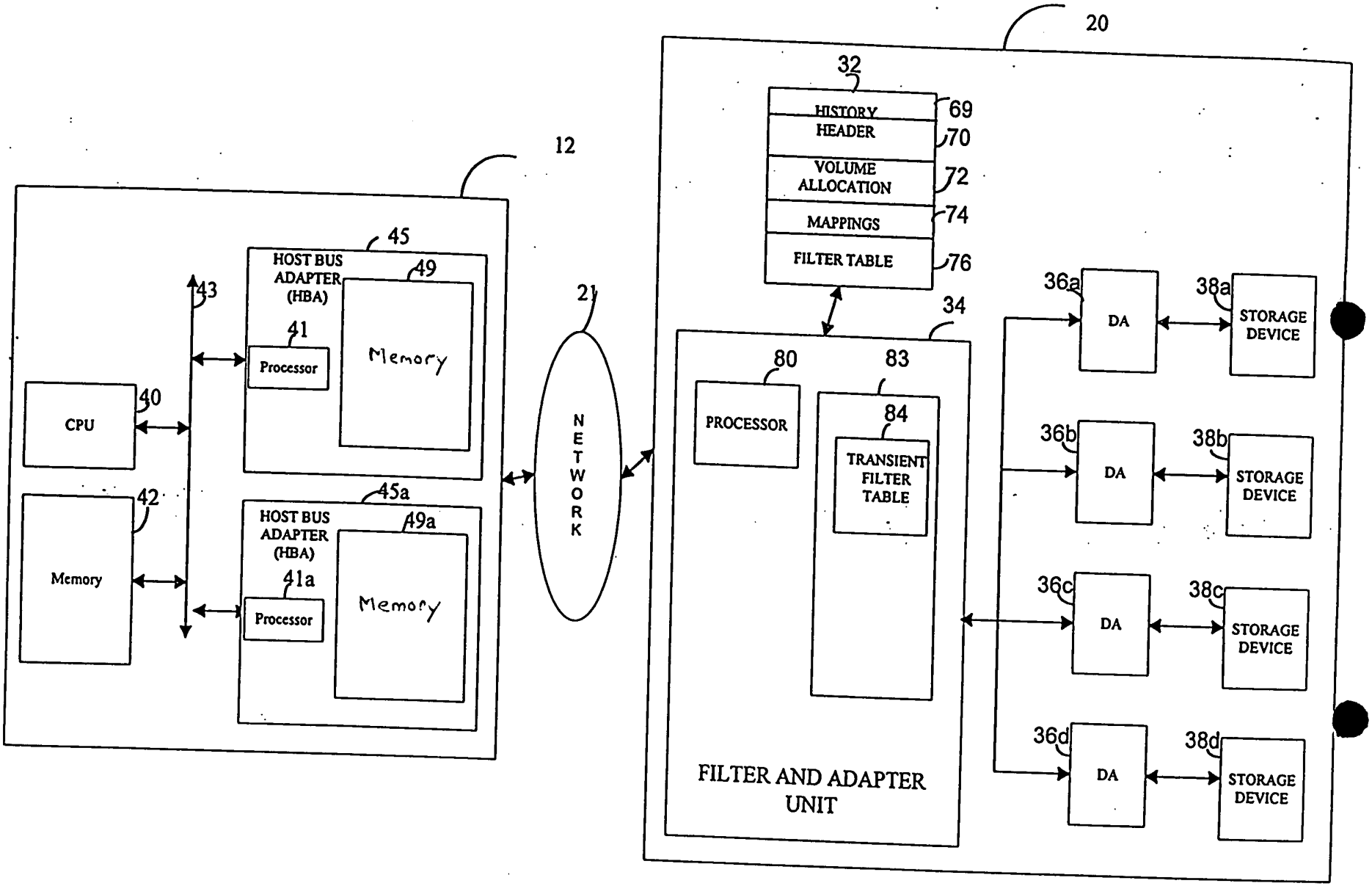

20
32
HISTORY
HEADER
VOLUME ALLOCATION
MAPPINGS
FILTER TABLE
69
70
72
74
76
12
45
HOST BUS ADAPTER (HBA)
49
Memory
41
Processor
43
CPU
40
Memory
42
45a
HOST BUS ADAPTER (HBA)
49a
Memory
41a
Processor
21
NETWORK
34
PROCESSOR
80
83
84
TRANSIENT FILTER TABLE
FILTER AND ADAPTER UNIT
36a
DA
38a
STORAGE DEVICE
36b
DA
38b
STORAGE DEVICE
36c
DA
38c
STORAGE DEVICE
36d
DA
38d
STORAGE DEVICE

FIG. 3

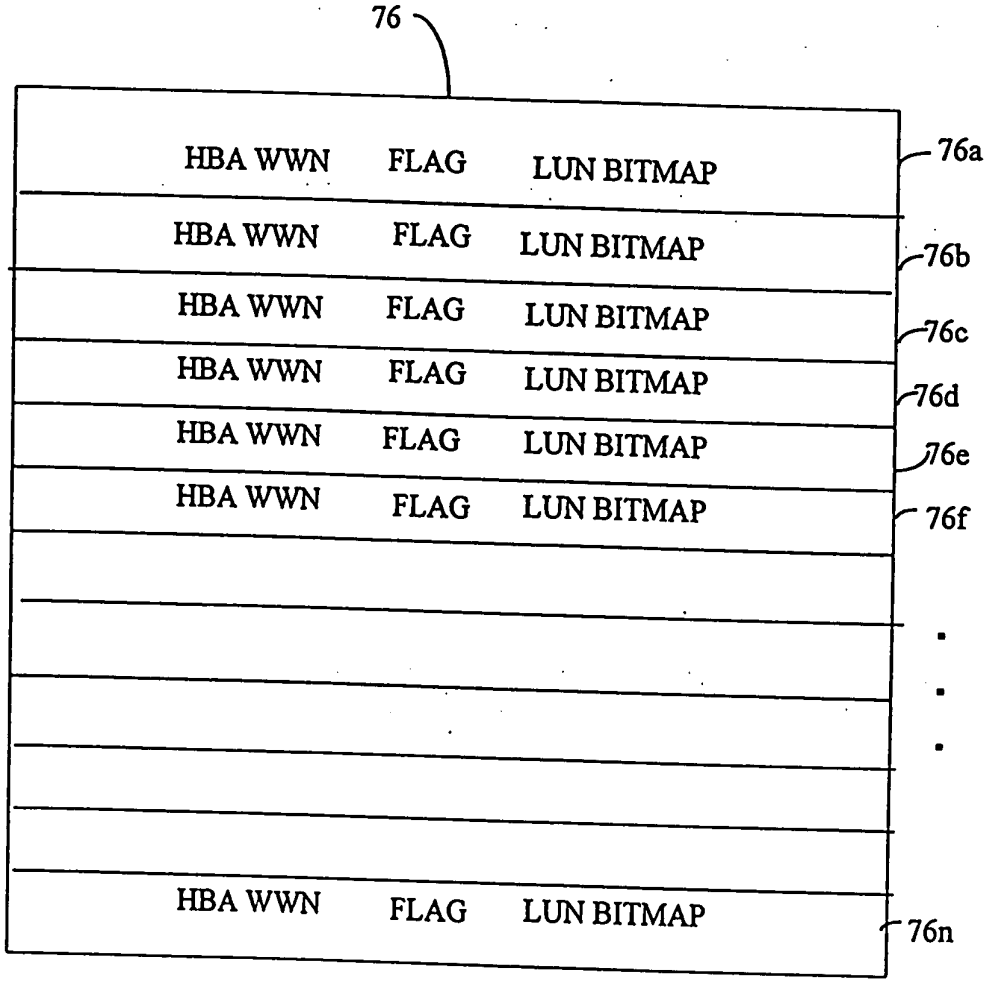

76
HBA WWN FLAG LUN BITMAP
76a
HBA WWN FLAG LUN BITMAP
76b
HBA WWN FLAG LUN BITMAP
76c
HBA WWN FLAG LUN BITMAP
76d
HBA WWN FLAG LUN BITMAP
76e
HBA WWN FLAG LUN BITMAP
76f
HBA WWN FLAG LUN BITMAP
76n

FIG. 4

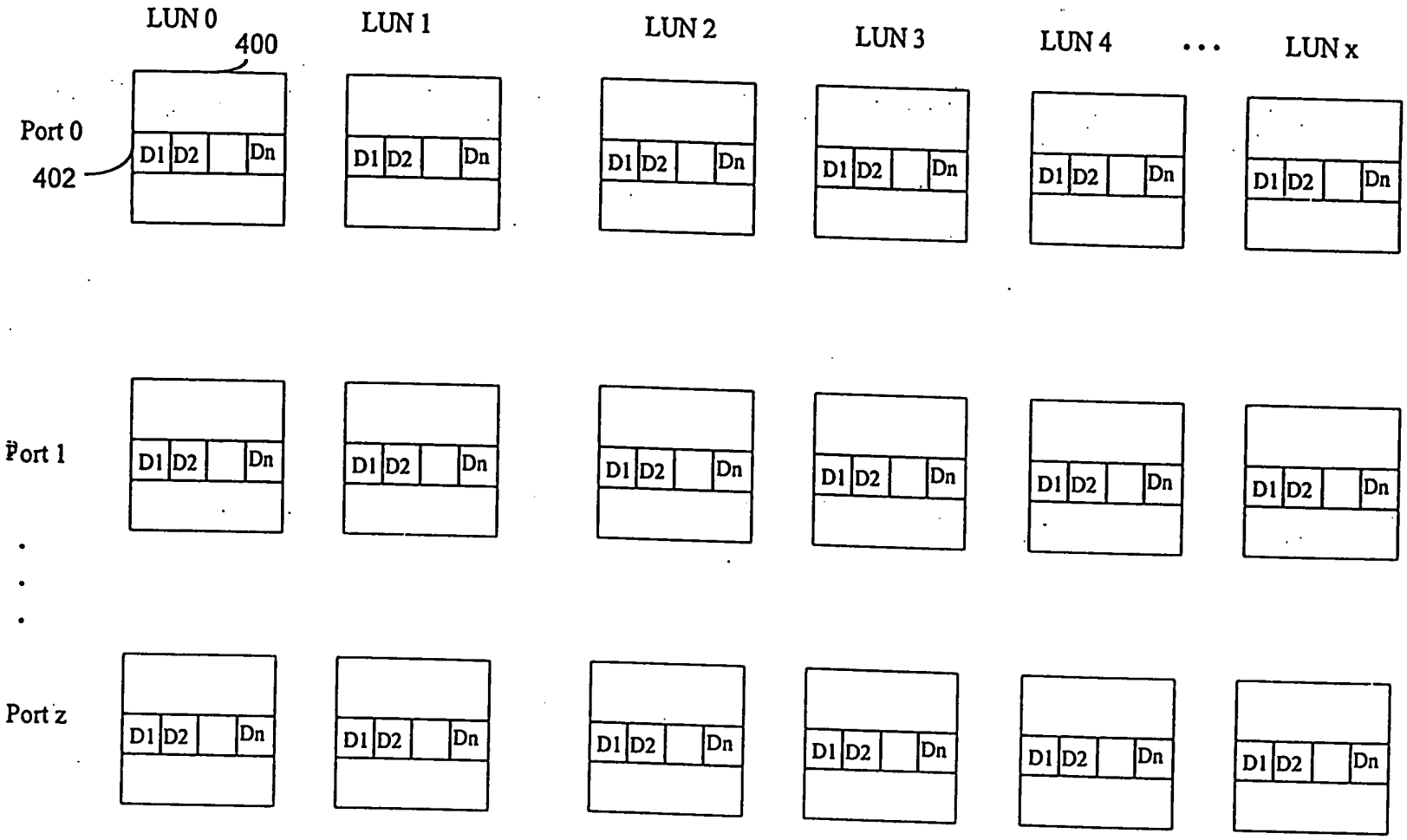

LUN 0
400
LUN 1
LUN 2
LUN 3
LUN 4
...
LUN x
Port 0
402
Port 1
Port z
D1
D2
Dn

FIG. 5

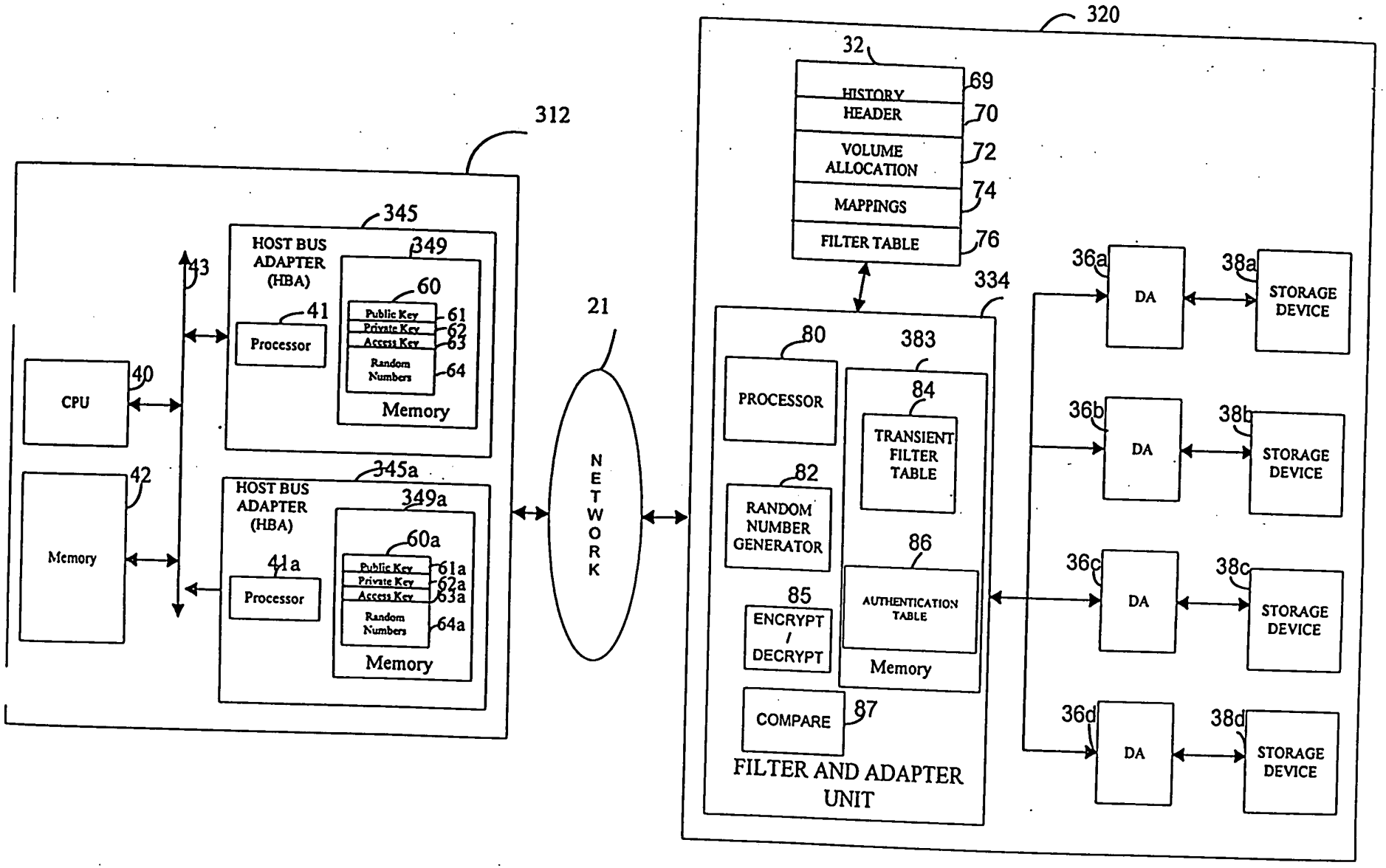

320
32
HISTORY
69
HEADER
70
VOLUME ALLOCATION
72
MAPPINGS
74
FILTER TABLE
76
312
345
HOST BUS ADAPTER (HBA)
349
60
Public Key
61
Private Key
62
Access Key
63
Random Numbers
64
Memory
41
Processor
43
CPU
40
Memory
42
345a
HOST BUS ADAPTER (HBA)
349a
60a
61a
62a
63a
64a
41a
Processor
Memory
21
NETWORK
334
80
383
PROCESSOR
84
TRANSIENT FILTER TABLE
82
RANDOM NUMBER GENERATOR
86
85
ENCRYPT / DECRYPT
AUTHENTICATION TABLE
Memory
COMPARE
87
FILTER AND ADAPTER UNIT
36a
DA
38a
STORAGE DEVICE
36b
DA
38b
STORAGE DEVICE
36c
DA
38c
STORAGE DEVICE
36d
DA
38d
STORAGE DEVICE

FIG. 6

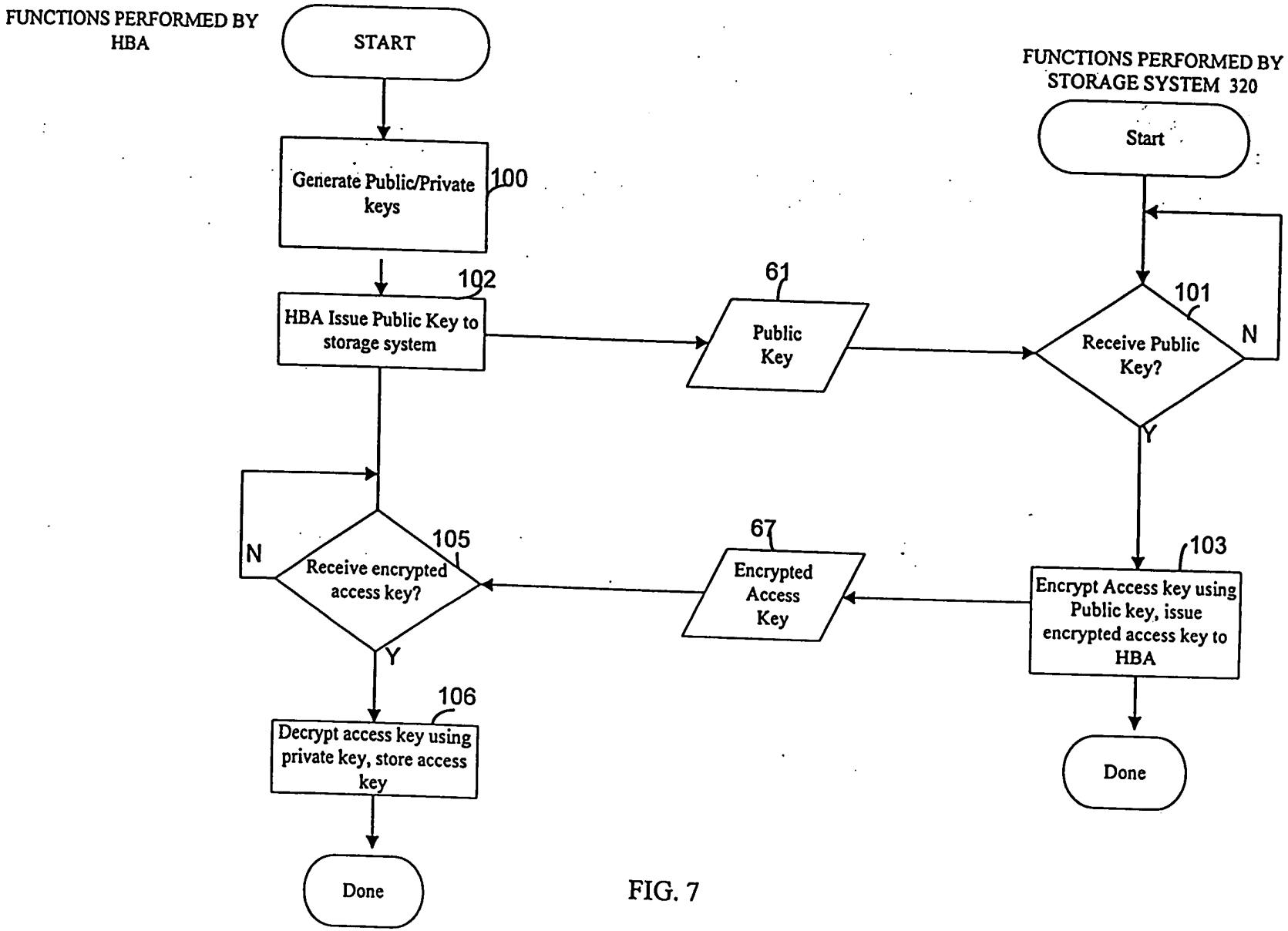

FUNCTIONS PERFORMED BY HBA
START
Generate Public/Private keys
100
HBA Issue Public Key to storage system
102
Public Key
61
FUNCTIONS PERFORMED BY STORAGE SYSTEM 320
Start
Receive Public Key?
101
N
Y
Encrypt Access key using Public key, issue encrypted access key to HBA
103
Done
Encrypted Access Key
67
Receive encrypted access key?
105
N
Y
Decrypt access key using private key, store access key
106
Done

FIG. 7

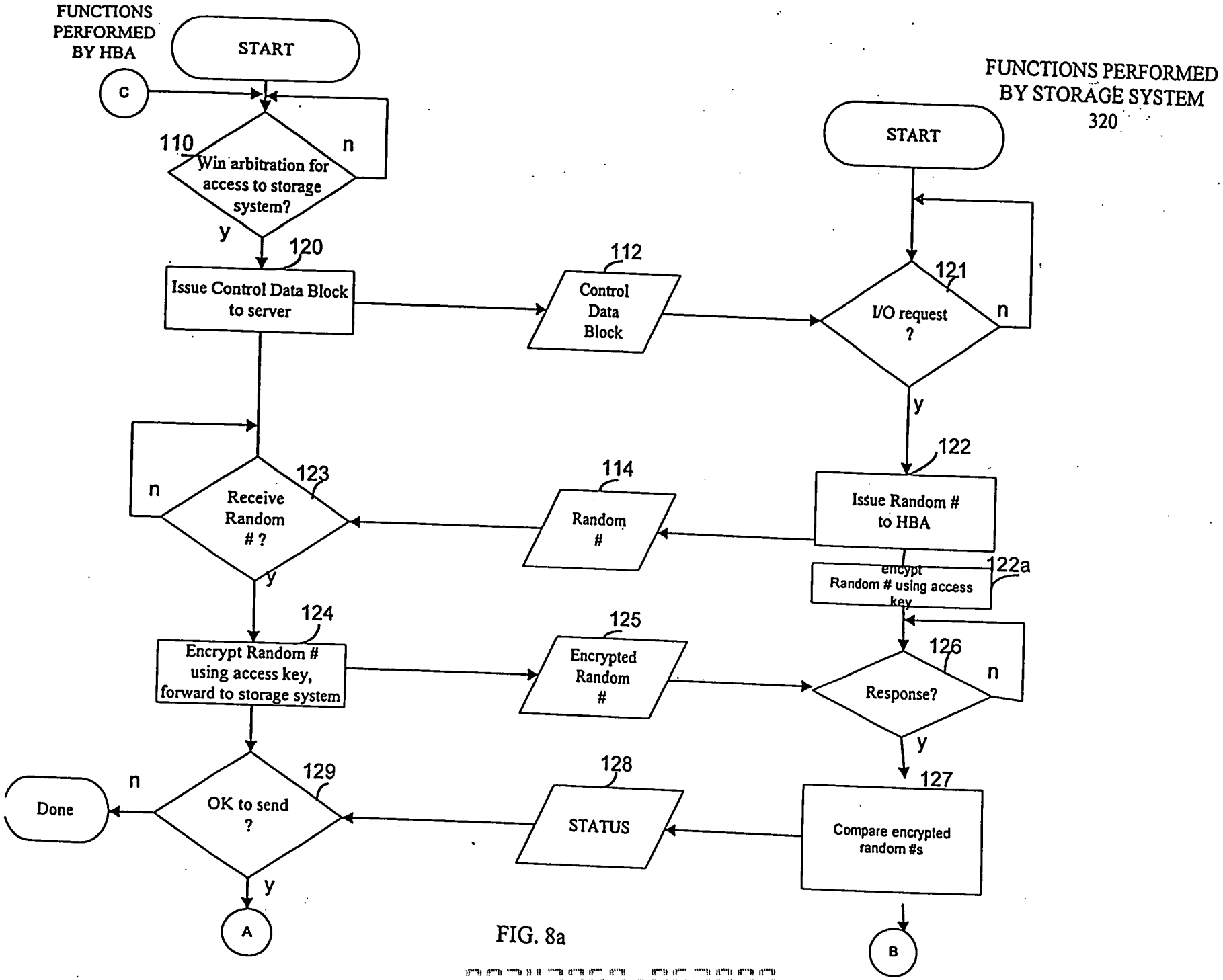

FUNCTIONS PERFORMED BY HBA
START
C
110
Win arbitration for access to storage system?
n
y
120
Issue Control Data Block to server
112
Control Data Block
FUNCTIONS PERFORMED BY STORAGE SYSTEM 320
START
121
I/O request ?
n
y
122
Issue Random # to HBA
114
Random #
123
Receive Random # ?
n
y
122a
encypt Random # using access key
124
Encrypt Random # using access key, forward to storage system
125
Encrypted Random #
126
Response?
n
y
129
OK to send ?
n
Done
y
A
128
STATUS
127
Compare encrypted random #s
B

FIG. 8a

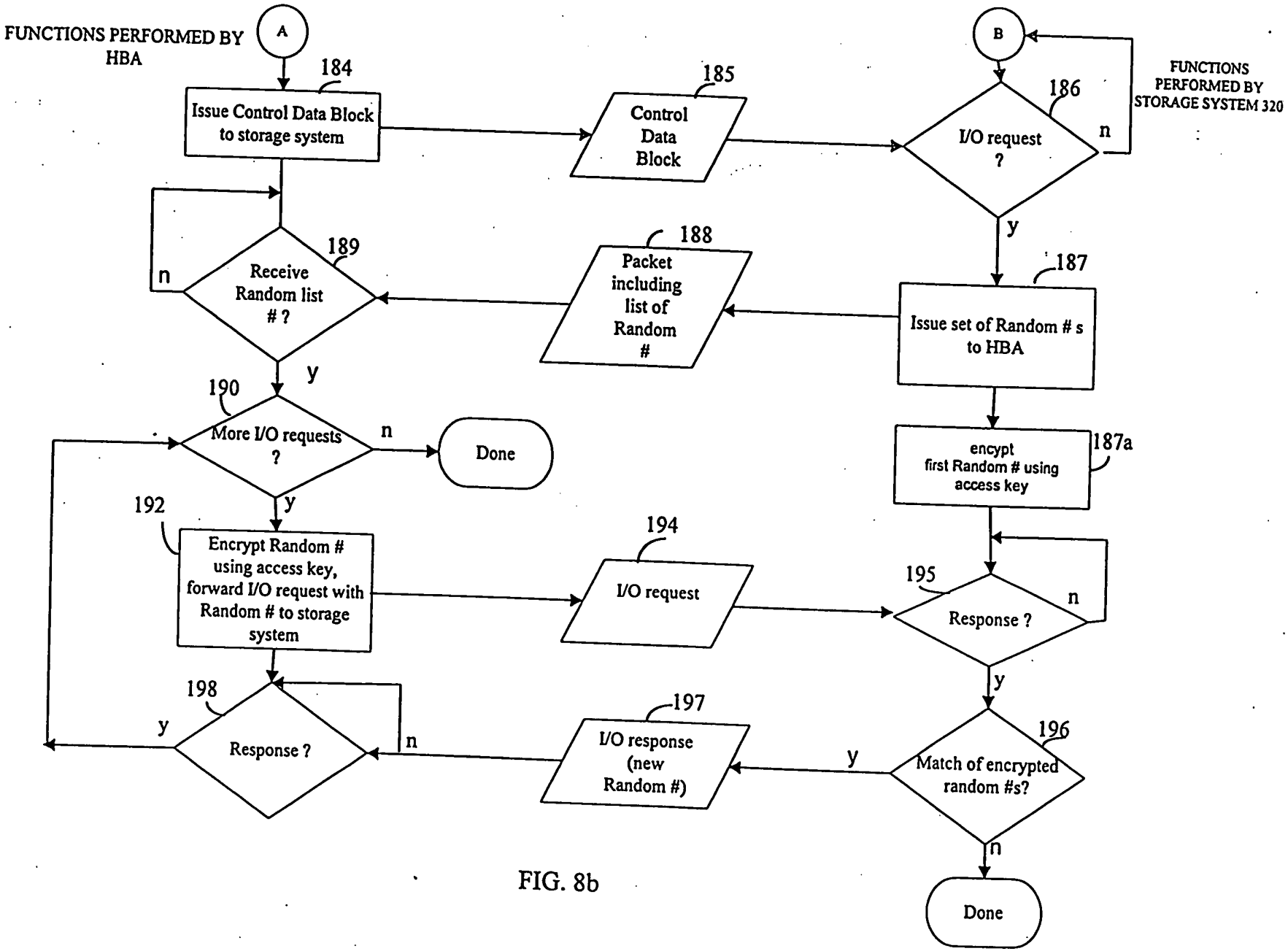

FUNCTIONS PERFORMED BY HBA
A
184
Issue Control Data Block to storage system
185
Control Data Block
B
186
I/O request ?
n
y
FUNCTIONS PERFORMED BY STORAGE SYSTEM 320
187
Issue set of Random # s to HBA
188
Packet including list of Random #
189
Receive Random list # ?
n
y
187a
encypt first Random # using access key
190
More I/O requests ?
n
Done
y
192
Encrypt Random # using access key, forward I/O request with Random # to storage system
194
I/O request
195
Response ?
n
y
196
Match of encrypted random #s?
y
197
I/O response (new Random #)
198
Response ?
y
n
n
Done

FIG. 8b

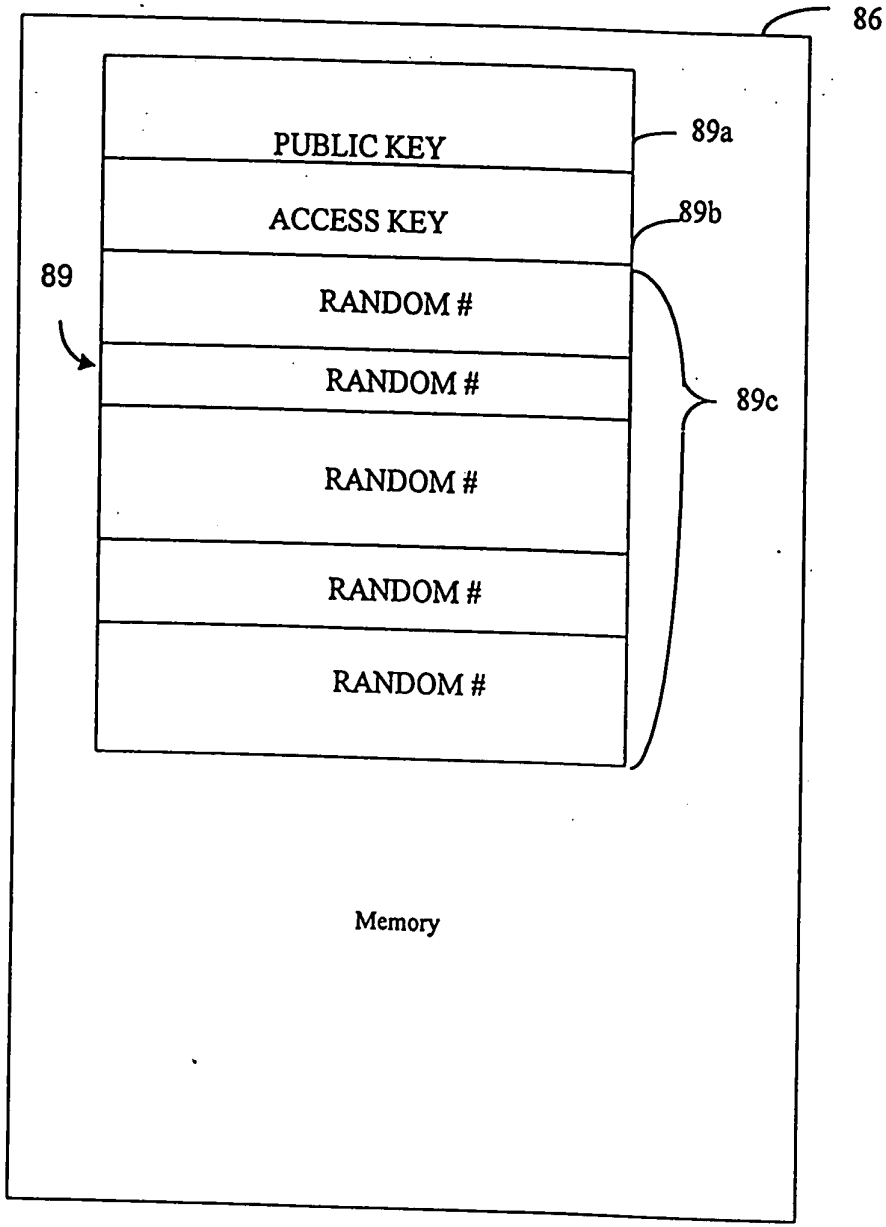

86
PUBLIC KEY
89a
ACCESS KEY
89b
89
RANDOM #
RANDOM #
89c
RANDOM #
RANDOM #
RANDOM #
Memory

FIG. 9

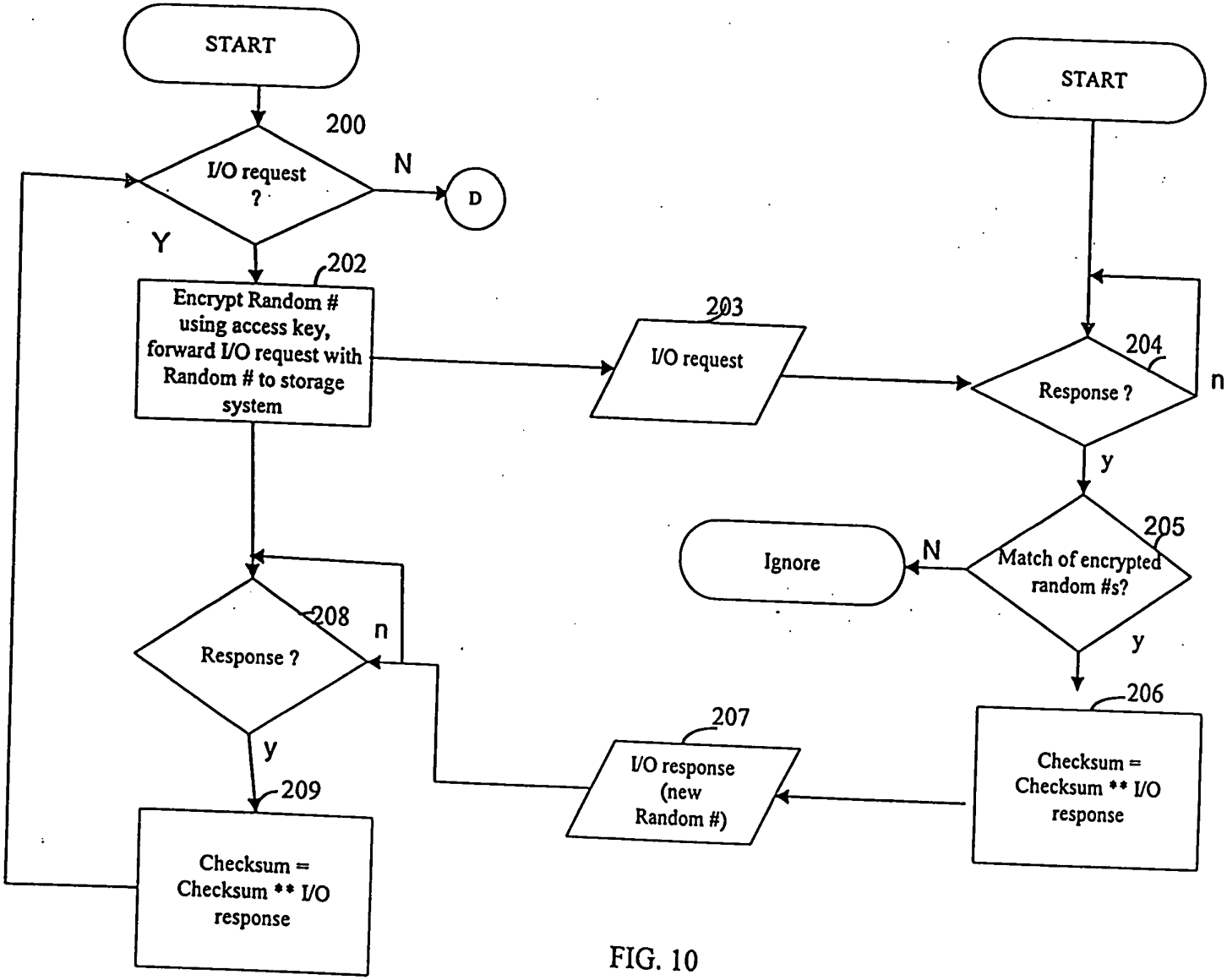
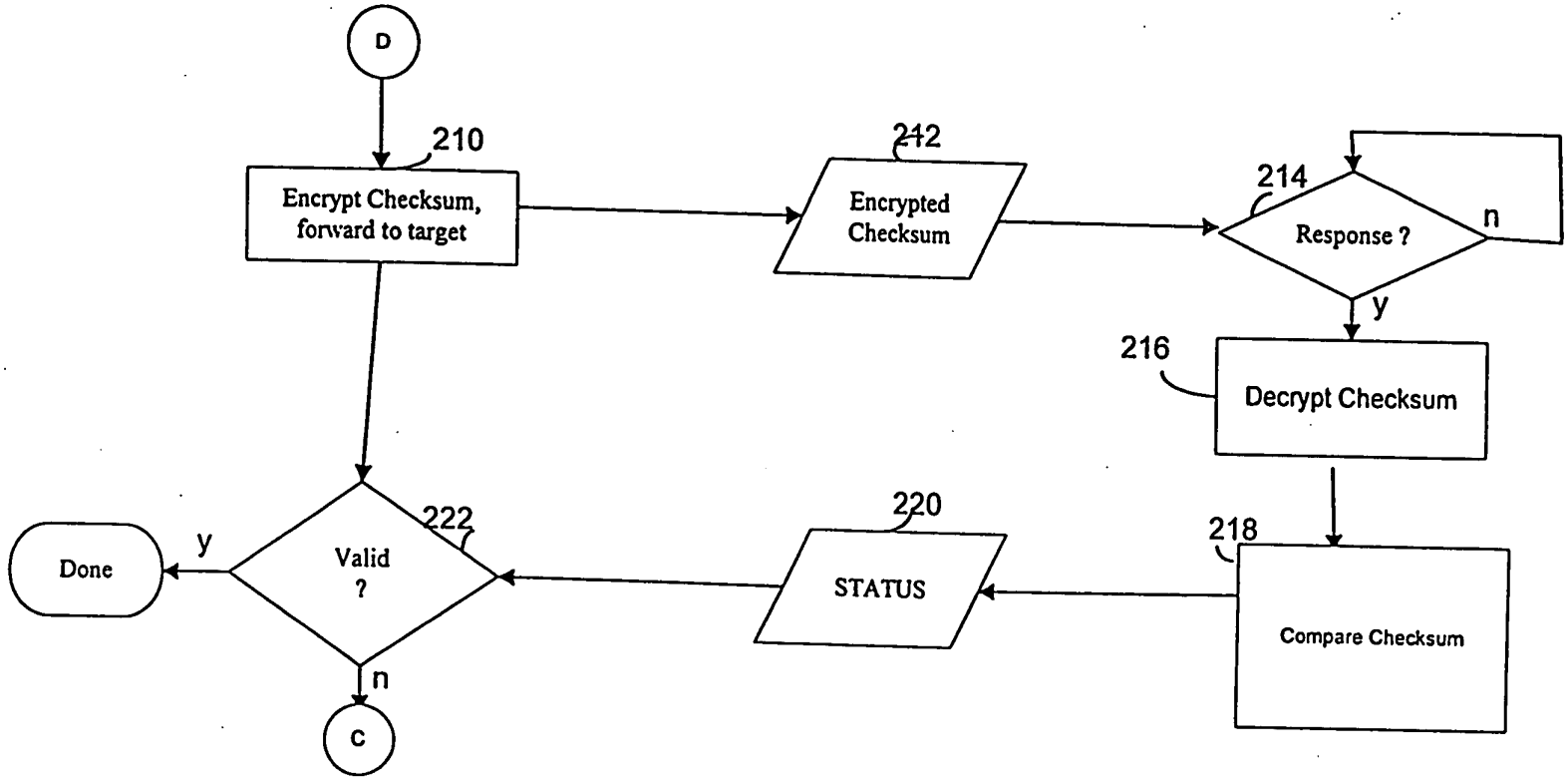

START
200
I/O request ?
N
D
Y
202
Encrypt Random # using access key, forward I/O request with Random # to storage system
203
I/O request
START
204
Response ?
n
y
205
Match of encrypted random #s?
N
Ignore
y
206
Checksum = Checksum ** I/O response
207
I/O response (new Random #)
208
Response ?
n
y
209
Checksum = Checksum ** I/O response

FIG. 10


D
210
Encrypt Checksum, forward to target
242
Encrypted Checksum
214
Response ?
n
y
216
Decrypt Checksum
218
Compare Checksum
220
STATUS
222
Valid ?
y
Done
n
C

(Fig. 7)

FIG. 11

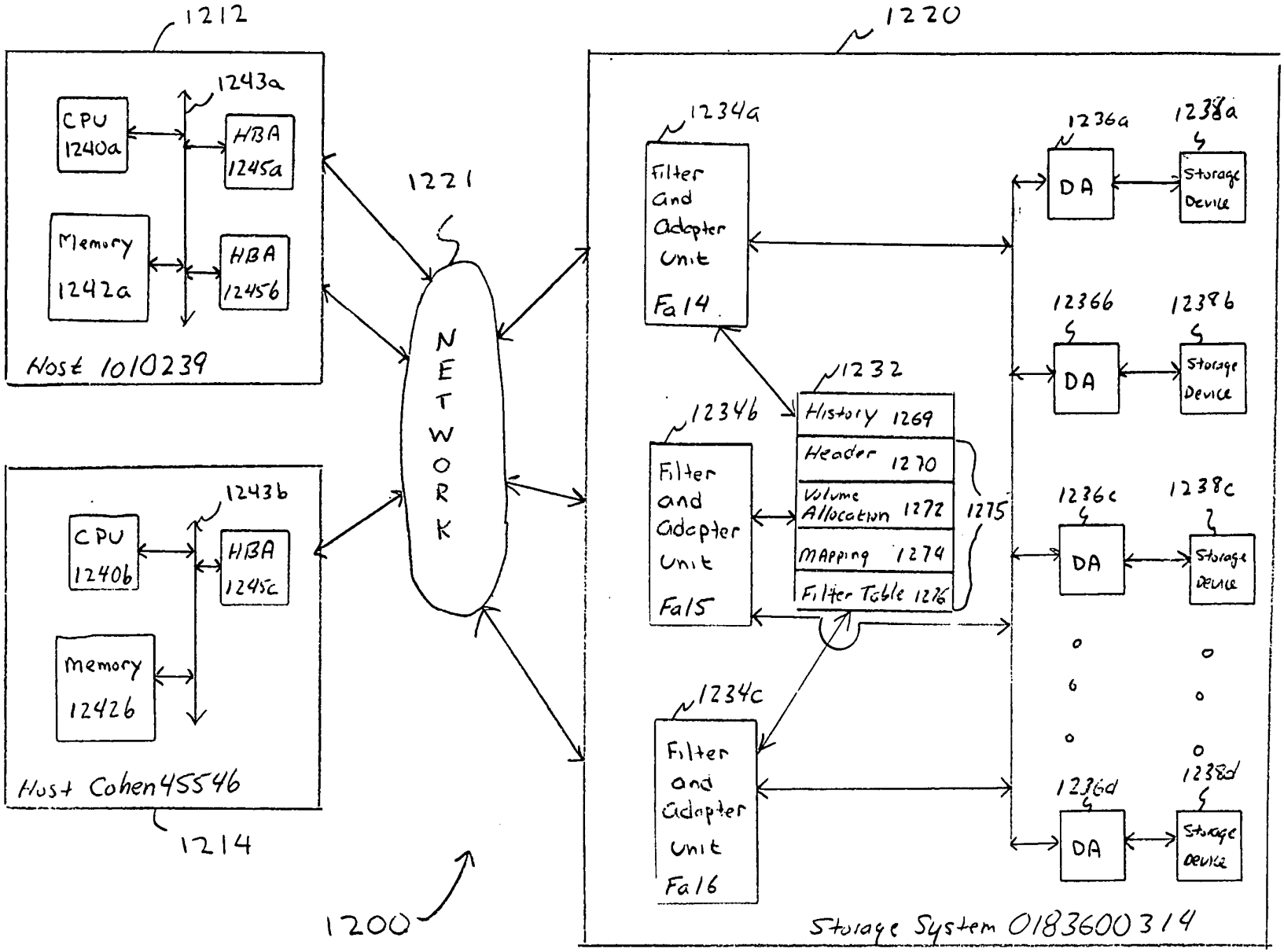

1212
1243a
CPU 1240a
HBA 1245a
Memory 1242a
HBA 12456
Host 1010239
1243b
CPU 1240b
HBA 1245c
Memory 12426
Host Cohen45546
1214
1200
1221
NETWORK
1220
1234a
Filter and Adapter Unit Fa14
1234b
Filter and Adapter Unit Fa15
1234c
Filter and Adapter Unit Fa16
1232
History 1269
Header 1270
Volume Allocation 1272
Mapping 1274
Filter Table 1276
1275
1236a
1238a
1236b
1238b
1236c
1238c
1236d
1238d
DA
Storage Device
Storage System 0183600314

Fig. 12

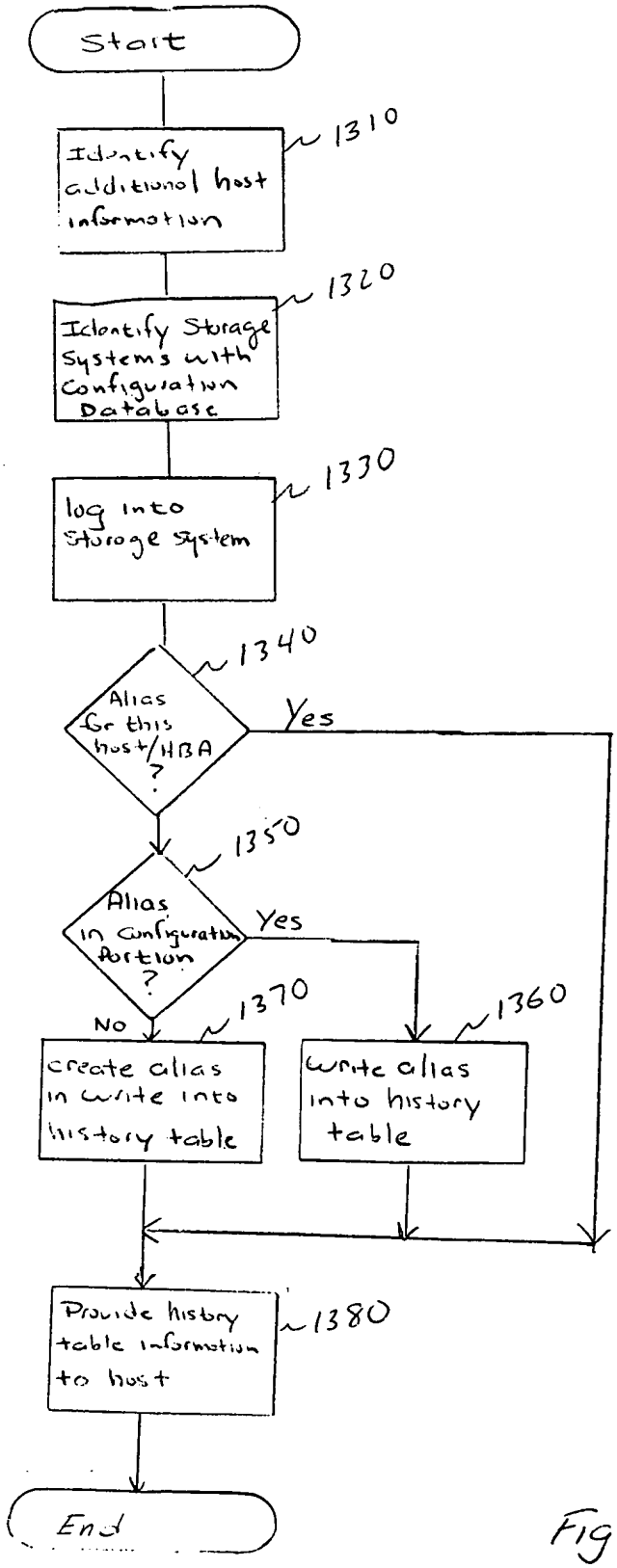

Start
Identify additional host information
1310
Identify Storage Systems with Configuration Database
1320
log into Storage System
1330
Alias for this host/HBA ?
1340
Yes
Alias in configuration portion ?
1350
Yes
No
create alias in write into history table
1370
write alias into history table
1360
Provide history table information to host
1380
End

Fig. 13

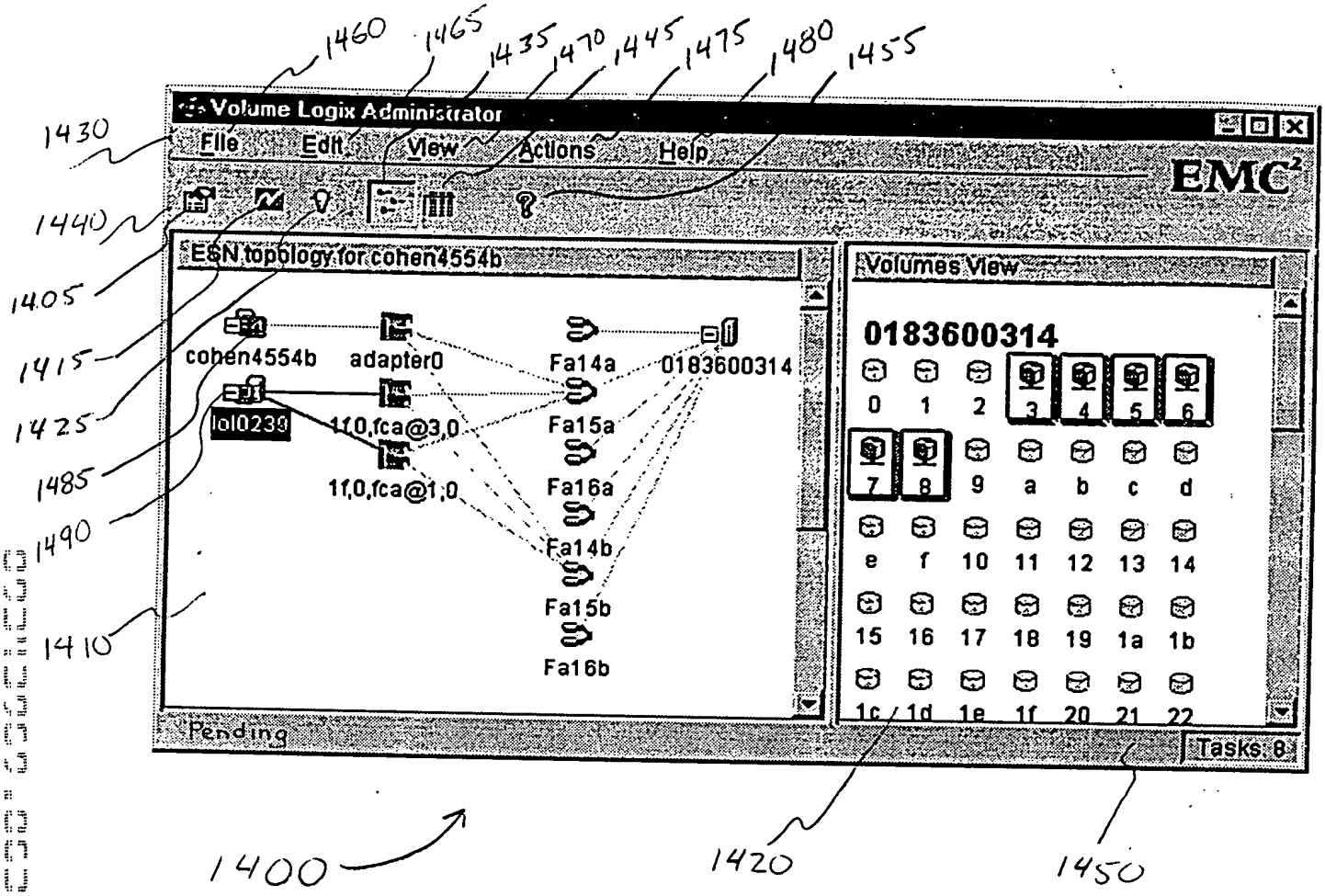

1460
1465
1435
1470
1445
1475
1480
1455
1430
1440
1405
1415
1425
1485
1490
1410
Volume Logix Administrator
File
Edit
View
Actions
Help
EMC²
ESN topology for cohen4554b
cohen4554b
adapter0
Fa14a
0183600314
lol0239
1f,0,fca@3,0
Fa15a
1f,0,fca@1,0
Fa16a
Fa14b
Fa15b
Fa16b
Volumes View
0183600314
0 1 2 3 4 5 6
7 8 9 a b c d
e f 10 11 12 13 14
15 16 17 18 19 1a 1b
1c 1d 1e 1f 20 21 22
Pending
Tasks: 8
1400
1420
1450

Fig. 14

1505		Storage System
1510		Storage Port
1515		Host Processor
1520		Administrator Host Processor
1525		Host Bus Adapter
1530		Storage Volume
1535		Assigned Storage Volume
1540		Shared, Assigned Storage Volume
1545		Configuration Database Storage Volume
1550		Mirrored Storage Volume
1555		Concatenated Storage Volume

Fig. 15

Volumes	Capacity	Symmetrix	Symm Ports	Owners
0	0.0	9000003077	Fa3a, Fa15a	sargent:FcaPort0
1	0.0	9000003077	Fa3a	sargent:FcaPort0
2	0.0	9000003077	Fa3a	sargent:FcaPort0
3	0.0	9000003077	Fa3a, Fa16b	sargent:FcaPort0
4	0.0	9000003077	Fa3a	sargent:FcaPort0
5	0.0	9000003077	Fa3a	None
6	0.0	9000003077	Fa3a	None
7	0.0	9000003077	Fa3a	vermeer:fca@2,0...
8	0.0	9000003077	Fa15a	sargent:FcaPort0
9	0.0	9000003077	Fa15a	sargent:FcaPort0
a	0.0	9000003077	Fa15a	None
b	0.0	9000003077	Fa15a	None
c	0.0	9000003077	Fa15a	None
d	0.0	9000003077	Fa15a	None
e	0.0	9000003077	Fa15a	None
f	0.0	9000003077	Fa15a	None
18	0.0	9000003078	Fa15b	None
19	0.0	9000003078	Fa15b	None
1a	0.0	9000003078	Fa15b	None
1b	0.0	9000003078	Fa15b	None
1c	0.0	9000003078	Fa15b	None
1d	0.0	9000003078	Fa15b	None
1e	0.0	9000003078	Fa14b, Fa15b	None
1f	0.0	9000003078	Fa14b, Fa15b	None
20	0.0	9000003078	Fa14b, Fa15b	None

1620

Fig. 16

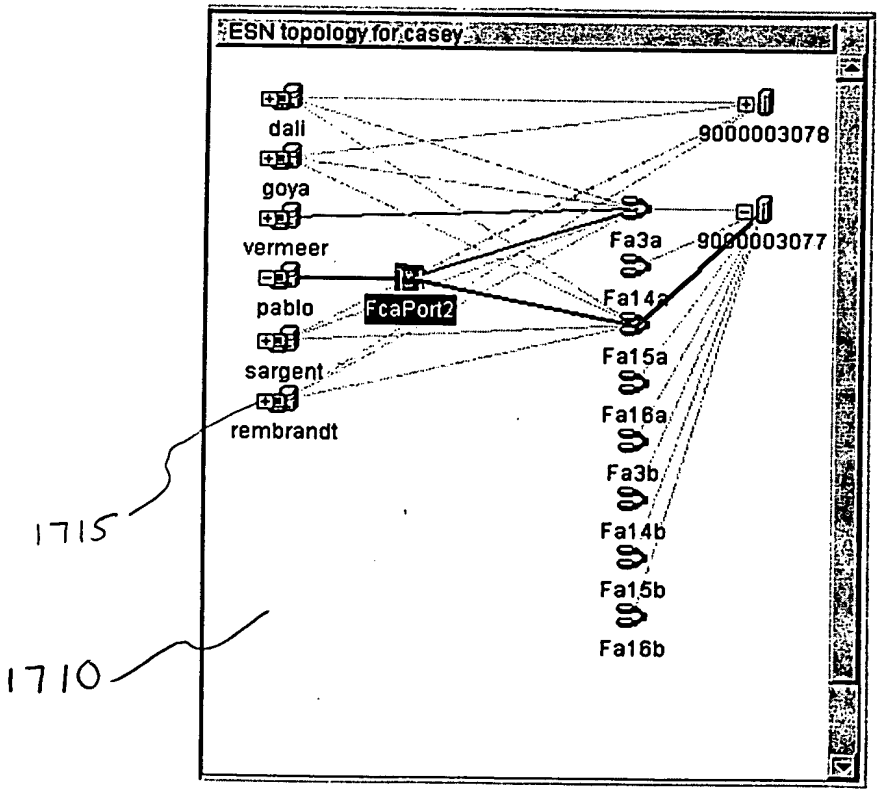

ESN topology for casey
dali
goya
vermeer
pablo
sargent
rembrandt
FcaPort2
9000003078
9000003077
Fa3a
Fa14a
Fa15a
Fa16a
Fa3b
Fa14b
Fa15b
Fa16b
1715
1710

Fig. 17

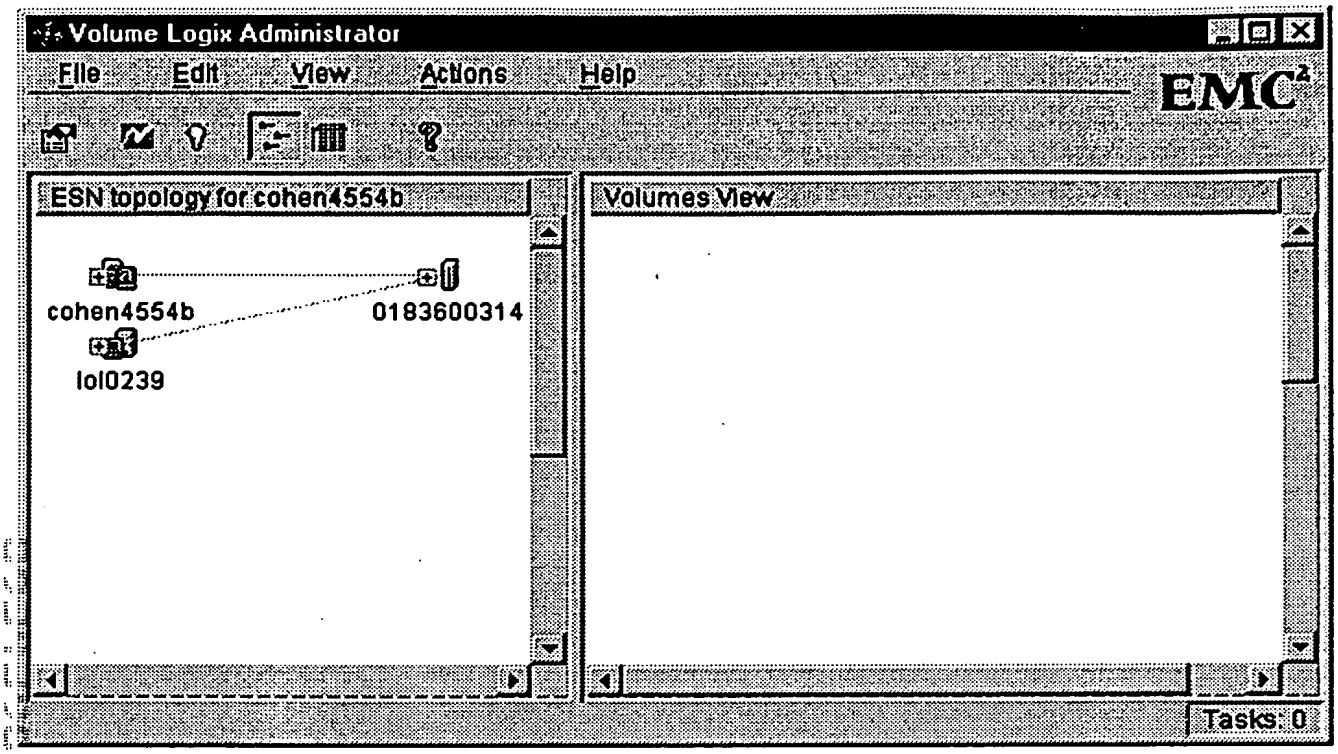

Volume Logix Administrator
File
Edit
View
Actions
Help
EMC²
ESN topology for cohen4554b
cohen4554b
0183600314
lol0239
Volumes View
Tasks: 0

Fig. 18

1800

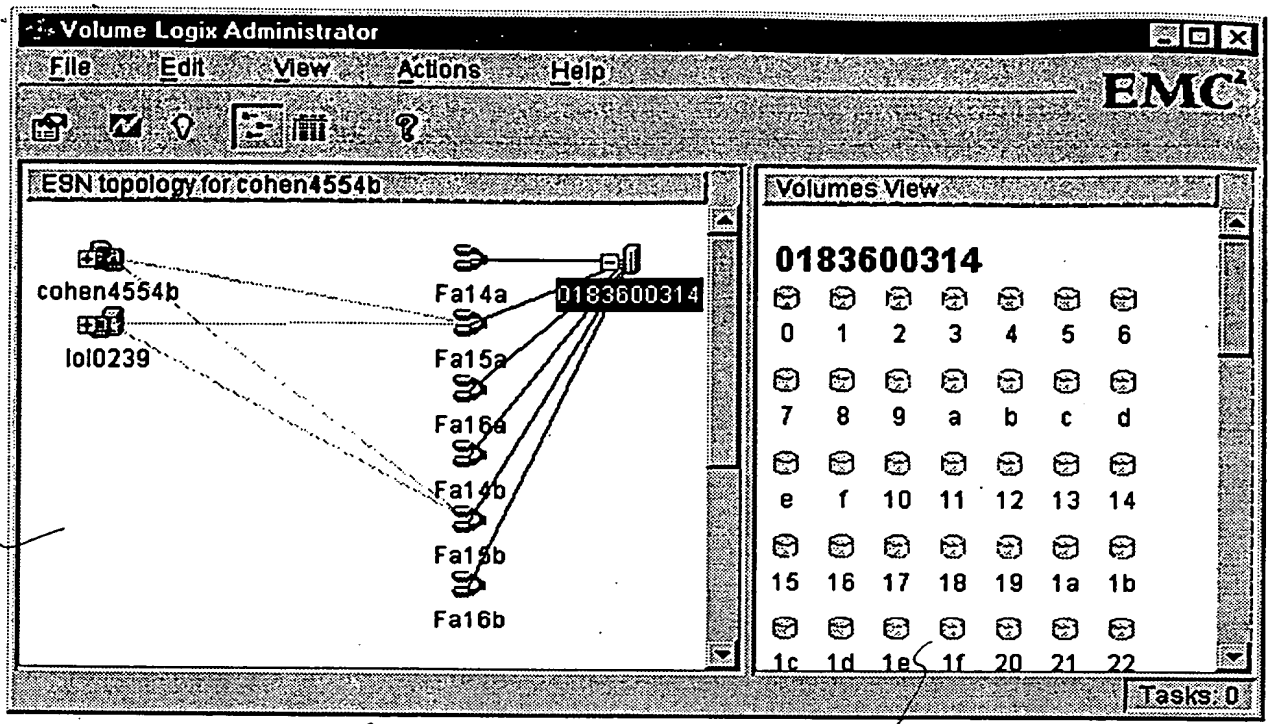
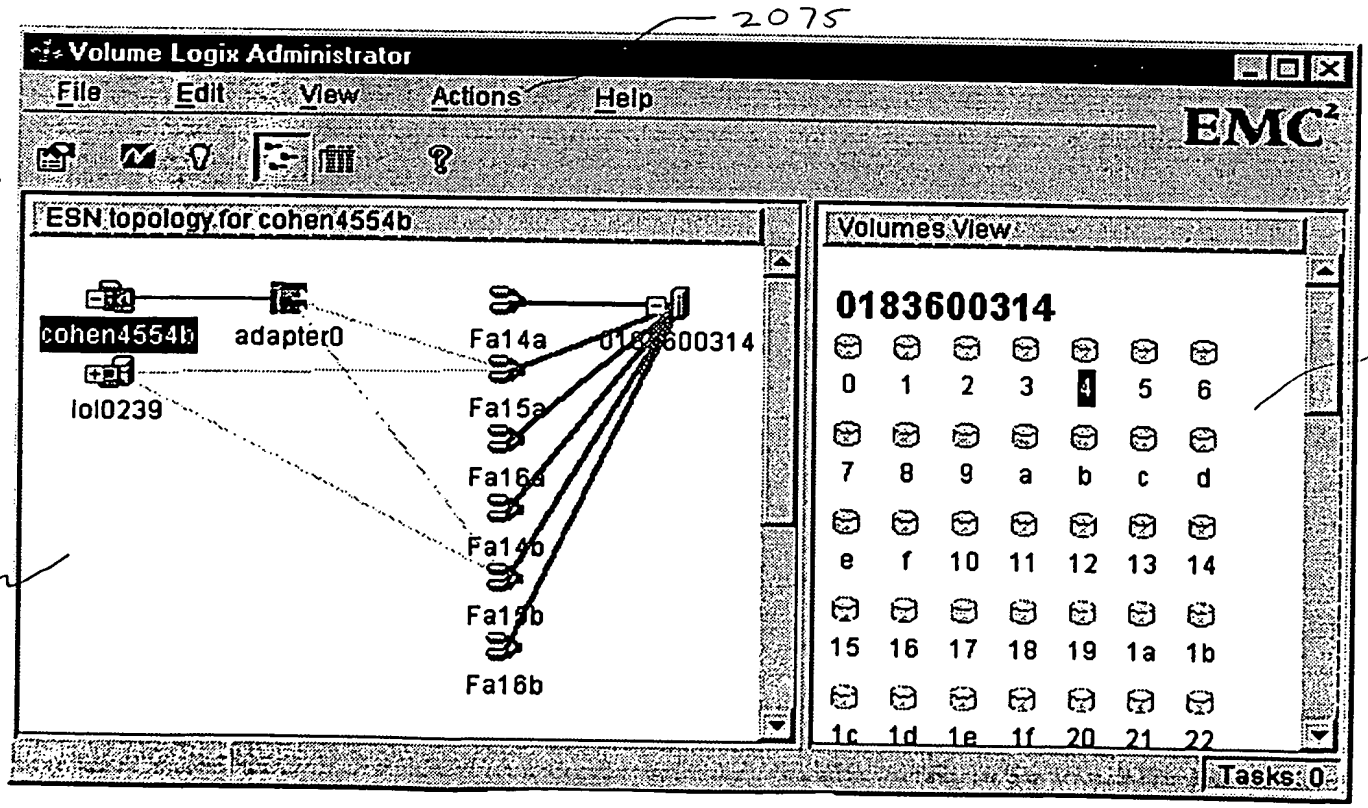

Volume Logix Administrator
File
Edit
View
Actions
Help
EMC²
ESN topology for cohen4554b
cohen4554b
lol0239
Fa14a
Fa15a
Fa16a
Fa14b
Fa15b
Fa16b
0183600314
Volumes View
0183600314
0 1 2 3 4 5 6
7 8 9 a b c d
e f 10 11 12 13 14
15 16 17 18 19 1a 1b
1c 1d 1e 1f 20 21 22
Tasks: 0
1910
1900
1920

Fig. 19

Fig. 20


2075
Volume Logix Administrator
File
Edit
View
Actions
Help
EMC²
ESN topology for cohen4554b
cohen4554b
adapter0
lol0239
Fa14a
Fa15a
Fa16a
Fa14b
Fa15b
Fa16b
0183600314
Volumes View
0183600314
0 1 2 3 4 5 6
7 8 9 a b c d
e f 10 11 12 13 14
15 16 17 18 19 1a 1b
1c 1d 1e 1f 20 21 22
Tasks: 0
2010
2020

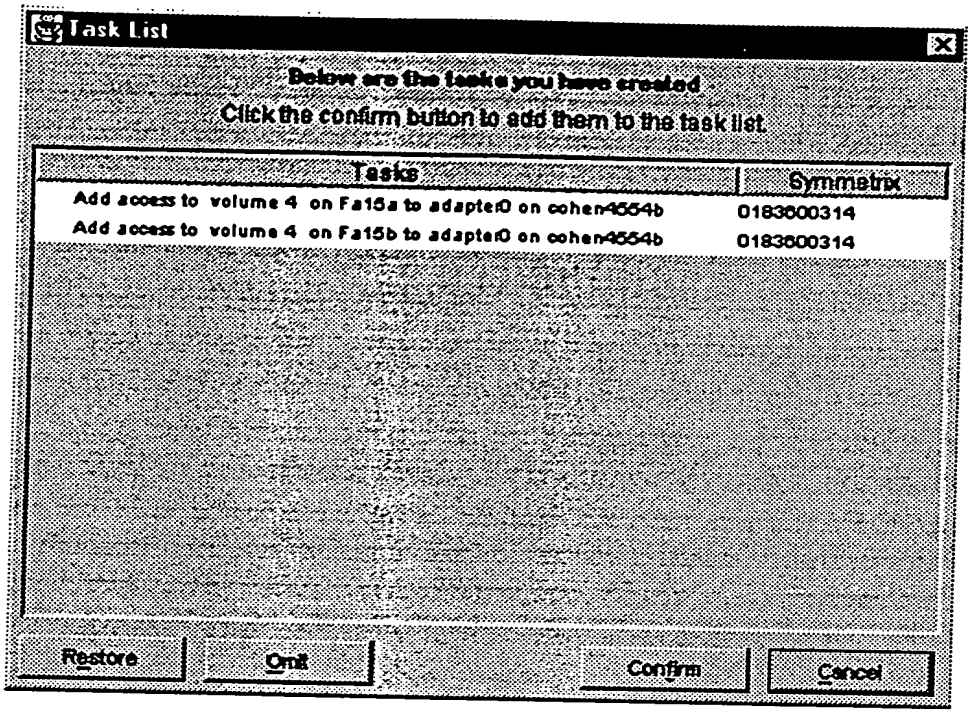

Task List
Below are the tasks you have created
Click the confirm button to add them to the task list.
Tasks
Symmetrix
Add access to volume 4 on Fa15a to adapter0 on cohen4554b 0183600314
Add access to volume 4 on Fa15b to adapter0 on cohen4554b 0183600314
Restore
Omit
Confirm
Cancel

Fig. 21

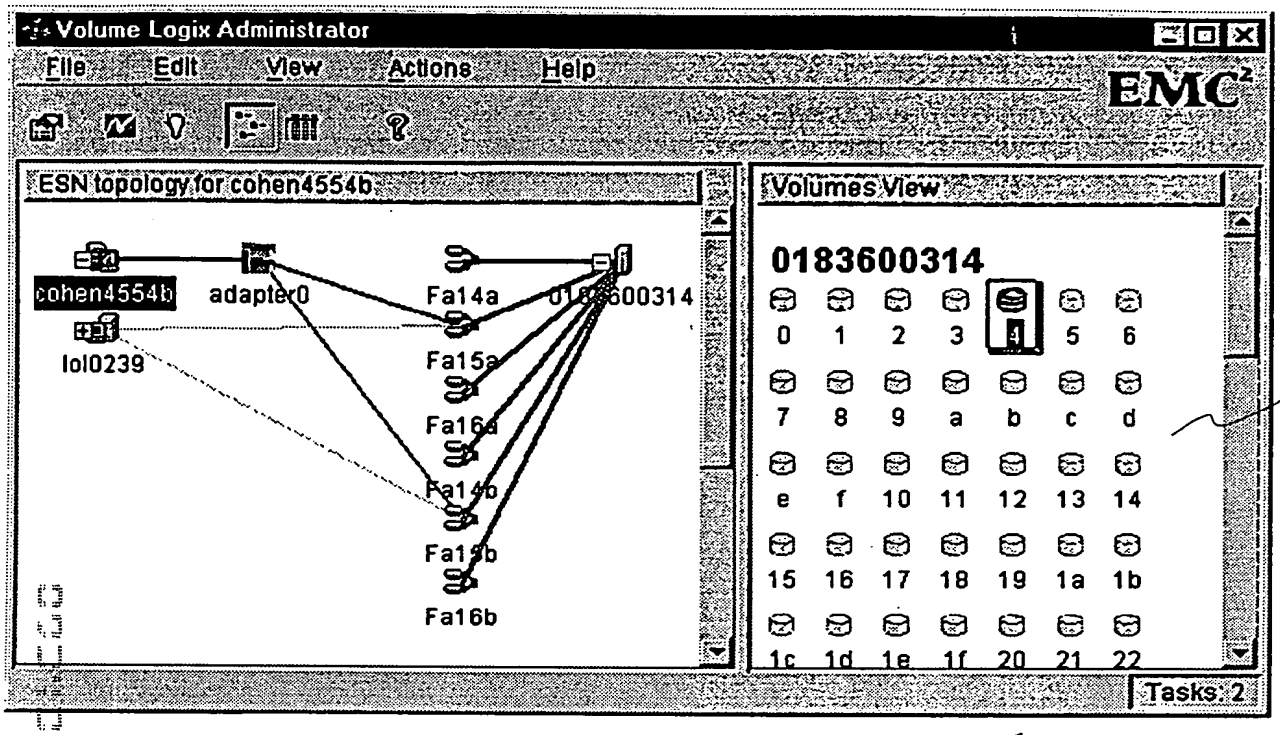

Volume Logix Administrator
File
Edit
View
Actions
Help
EMC²
ESN topology for cohen4554b
cohen4554b
adapter0
lol0239
Fa14a
Fa15a
Fa16a
Fa14b
Fa15b
Fa16b
0183600314
Volumes View
0183600314
0 1 2 3 4 5 6
7 8 9 a b c d
e f 10 11 12 13 14
15 16 17 18 19 1a 1b
1c 1d 1e 1f 20 21 22
Tasks: 2
2220
2200

Fig. 22